C T E R N F R O C A L T E C H N O L O G Y: 
W H Y W E A R E H E R E 

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Indiana Primary Energy Consumption
Source & Sector, 2004 (Trillion Btu, 10^{12} Btu)

**SOURCE % & SECTOR %**

- **COAL**
  - 1,614
  - 52.3%

- **PETROLEUM**
  - 885
  - 28.7%

- **NATURAL GAS**
  - 543
  - 17.6%

- **RENEWABLES**
  - 45
  - 1.5%

**ELECTRIC POWER**
- **INDUSTRIAL**
  - 1,400.2
  - 47.5%

- **RESIDENTIAL & COMMERCIAL**
  - 531.5 + 373.0 = 904.5
  - 30.7%

- **TRANSPORTATION**
  - 641.0
  - 21.8%

**Total = 3.087 Quads (10^{15} Btu)**

Net inter-state flow of electricity/losses = -142 (export)

http://www.eia.doe.gov/emeu/states/state_energy_profiles.cfm?sid=IN
http://www.eia.doe.gov/emeu/states/state.html?q_state_a=in&q_state=INDIANA
Coal Use Trend

Indiana coal consumption growing much faster than Indiana coal production

![Graph showing the trend of coal use in Indiana over the years, with a linear trend line indicating a steady increase.](image)
Coal Answer to the Emissions problem?

Increasing the use of electricity focuses the emissions issue back to the Utility, rent pollution control when you buy electricity.

Coal Use Grows While Emissions Decline

Coal Used for Electricity Has Tripled
Since 1970 While Emissions Have Been Significantly Improved

*Figure ES.2* Source: EPA National Air Pollutant Emission Trends Dec 2004; EIA Annual Energy Review 2003 (September 2004)
Coal prices are relatively stable in real terms while other forms continue to rise.

In Indiana coal = electricity

Low energy price helps the economy of the state.
If we have a least cost option, use it.
Indiana electric requirement by scenario
45.9% increase in electric demand in next 17 years, SUFG
The Real Problem
We are not ready

The Energy Workforce of the Future

- All energy industries face issues
  - Coal miners are retiring; average age 51
  - Technologies are changing
  - Boilermakers are offshore
  - Nuclear welders do not exist
  - Stigma of a vocational technical education
  - Power generation industry – average age 50
    - Employs 1 million nationwide
    - ½ workforce retirement in 5-10 years
    - 62% of managers are 50 and older
    - 61% of line superintendents are 50 and older
    - 43% of foremen are 50 and older

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What Will Work to Meet the Demand?

Don’t confuse Energy Efficiency with Government Control

Global Energy Forms Face Limits in Supply & Price

All Energy Forms Needed for Diversity of Supply

ENERGY EFFICIENCY/DEMAND-SIDE MANAGEMENT/CONSERVATION
An important resource but insufficient to power the future

OIL
Consistently above $50/barrel; declining reserves; risky sources

NUCLEAR
Valuable but constrained due to safety and waste disposal concerns

HYDRO
No growth in supply

WIND
Limited availability; grid disruptions; erratic supply

ETHANOL
Clean but energy inefficient; strains food supplies; cellulosic key

NATURAL GAS
Consistently above $6/mcf; declining reserves; risky sources

Courtesy: Peabody Energy, 2007
Evolution of the Coal Power Plant

Yet the electricity per ton of coal input stays level

Figure ES-1
Evolution of Coal Fired Power Plant Emissions Capture$^2$
It takes power to make power

Size comparison of original PC to new technology

IGCC Project Layout
Can We Use Coal?

A Multi-Step Process to Near-Zero Emissions from Coal

A Long-Term Approach to a Long-Term Challenge

- Building New, Efficient Supercritical & IGCC Coal Plants 15% Lower CO₂ Emissions
- Demonstrating FutureGen: IGCC and Carbon Capture/Sequestration Up to 90% Lower CO₂ Emissions
- Retrofitting Existing Coal-Based Generation with Carbon Capture/Sequestration Up to 90% Lower CO₂ Emissions

The Goal: Near-Zero Emissions

Courtesy: Peabody Energy, 2007

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CO$_2$ Cost

- Analysis conducted at NETL shows that CO$_2$ capture and compression using amines raises the cost of electricity from a newly-built supercritical PC power plant by 84%, from 4.9 cents/kWh to 9.0 cents/kWh.

- Analysis conducted at NETL shows that CO$_2$ capture and compression using Selexol raises the cost of electricity from a newly built IGCC power plant by 25%, from 5.5 cents/kWh to 6.5 cents/kWh.

Source: “Carbon Sequestration and CO2 Capture”: NETL